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Rocky Mountain Region

U.S. Department of Agriculture Forest Service

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An Evaluation of Engelmann Spruce Seedling Tip Dieback at Bessey Nursery, Nebraska

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INTRODUCTION

On May 21, 1979, a field evaluation was conducted on tip necrosis of 1-0 Engelmann spruce (*Picea engelmanni* Parry) at the Bessey Nursery, Halsey, Nebraska by Robert James, Plant Pathologist. Tim Capistrant, Bessey Nurseryman, was concerned about possible pathogenic organisms involved and ways of reducing future losses.

Field examinations and laboratory investigations were undertaken to determine etiology of the disorder. Samples of necrotic tissue were taken to the laboratory for culturing of pathogenic organisms.

RESULTS AND DISCUSSION

Affected seedlings displayed tip necrosis of current year's foliage (Fig. 1). Dieback was often restricted to apical tips; however, in some cases lateral flushes of foliage also displayed necrosis. Affected seedlings were scattered throughout seedbeds.

Field examinations failed to reveal signs of pathogenic organisms such as mycelium or fruiting structures. Levels of dieback on affected trees were rather uniform which would suggest possible weather related damage. Isolations from symptomatic tissues yielded a number of fungi, some of which were potential pathogens.

Phoma sp. was a commonly isolated fungus. It produced globose, ostiolate, light-brown pycnidia measuring about 130-140 µm x 125-140 µm. Pycnidia produced one-celled, hyaline, slightly elongated conidia measuring 1-2 µm in width by 4-6 µm in length. *Phoma* spp. have been associated with mortality of lodgepole pine seedlings at Bessey Nursery (6) and Douglas-fir seedlings at the Humbolt Nursery in California (10). This facultative parasite is a common soil inhabitant and usually attacks only stressed trees (6, 10). The *Phoma* sp. associated with necrotic tips of spruce seedlings may have been saprophytic and colonized tissues killed by some other agent.

Alternaria spp. were also isolated from necrotic tissues. These fungi produced brown-pigmented, multi-septate, club-shaped conidia which were attached end to end on septate conidiophores. *Alternaria* spp. may be parasites or saprophytes. Most parasitic forms incite leaf spot diseases (5). However, Foster and Harrison (4) found *Alternaria* associated with dying terminals and laterals of Arizona cypress in Georgia. Certain species of *Alternaria* have

FIGURE 1. Engelmann spruce seedlings displayed tip dieback at Bessey Nursery, Nebraska.

also displayed some pathogenic potential for jack pine seedlings (13). *Alternaria* spp. may mask the true pathogens because of its rapid growth and tendency to overrun slower growing fungi (3). Therefore, the *Alternaria* spp. found associated with dying spruce terminals may not be the primary cause of the disease.

Another fungus commonly associated with diseased spruce seedlings was *Epicoccum* sp. This fungus produced dark pigmented, multiseptate globose conidia with serrated margins. Conidia measured approximately 75-80 µm in diameter. Conidiophores were produced on stromatic cushions called sporodochia. Members of this genus are saprophytic or weakly parasitic. They are common on many different plants, decaying herbaceous debris and wood, and are found within the soil (11). *Epicoccum* sp. associated with diseased spruce seedlings was most likely a secondary colonizer of dead tissues rather than a primary parasite.

Gonatobotrys sp. was also isolated from necrotic terminals. This fungus produced hyaline, one-celled, ovoid to subglobose conidia (botryoblastospores) which were produced as intercalary clusters along hyaline, septate conidiophores. Conidia measured about 15-20 µm in length and 2-4 µm in width. *Gonatobotrys* spp. may be parasitic on *Alternaria* (11, 14) or saprophytic on plant debris (1). The association of this fungus with diseased spruce seedlings is probably secondary.

The final major fungal associate was *Fusicladium* sp. This fungus produced light-brown, one-or two-celled conidia borne successively at the apex of sympodial growing conidiophores. Conidia measured about 2 x 6 µm. Members of this genus have been implicated in several types of plant disease. A *Fusicladium* species was reported forming witches' brooms on *Amelanchier alnifolia* in Washington (12). *Fusicladium* is also an imperfect stage of *Venturia*, a common leaf spot pathogen (5, 9). Therefore, *Fusicladium* sp. may be involved in tip dieback of spruce seedlings.

Environmental factors probably played an important role in the appearance of diseased spruce seedlings. Parasitism by the associated fungi recovered from symptomatic trees was probably limited by host vigor. Therefore, one would expect other factors, such as weather extremes, to predispose seedlings to these facultative parasites. Direct tissue injury such as that induced by sub-freezing temperatures following spring bud break could provide suitable substrates for invasion by these fungi. The general patterns of dieback found are reminiscent of this type of damage. Young, succulent spruce tips are particularly prone to frost damage (8). Winter damage was also common on trees within the Nebraska National Forest near the nursery this past year (7).

Pathogenicity of the fungi associated with tip dieback of spruce seedlings can only be established through carefully controlled inoculation experiments. Such inoculations would have to result in duplication of the symptoms found in order to prove pathogenicity.

RECOMMENDATIONS

1. Continue monitoring beds for appearance of trees with symptoms similar to those previously found. In particular, symptomatic trees which are found at times when frost damage cannot be implicated should be examined carefully. Samples should be cultured for presence of pathogenic organisms.

2. If Engelmann spruce is to be produced in large quantities in the future at Bessey Nursery, some protection from frost injury may be warranted. This could include overhead irrigation just prior to the expected frost (ice covering young, susceptible foliage could theoretically protect it from damage by lower ambient temperatures). Lath coverings can be left over seedlings until the chance for spring frosts is over. Damage by early frosts can also be controlled by avoiding late spring sowing and by cultural methods to discourage growth of the stock in the late summer so that the tender tissues will harden early. Mulching before early frosts occur is also effective (2).

3. No chemical fungicide application is warranted at this time.

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